

DRV8343H-Q1EVM and DRV8343S-Q1EVM User's Guide

This document is provided with the DRV8343H-Q1EVM and DRV8343S-Q1EVM customer evaluation modules (EVMs) as a supplement to the [DRV8343-Q1 Automotive 5.5 to 60-V Three-Phase Smart Gate Driver With Three Integrated Current-Shunt Amplifiers data sheet](#). The scope of this document is to provide the user with a guide to evaluate the DRV8343x-Q1EVM. This document details the hardware implementation of the EVM and how to use the DRV8343x-Q1EVM with the provided software.

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1 Overview

The DRV8343x-Q1EVM is a fully functional, highly configurable three-phase brushless DC (BLDC) motor driver evaluation platform designed for 12-V to 24-V systems and up to 20-A maximum load. The EVM is designed to highlight the DRV8343x-Q1, a three-phase BLDC motor gate driver for automotive applications. The DRV8343x-Q1EVM can also be used to evaluate the DRV8340x-Q1, which features the same gate drive performance, but does not include the three current sense amplifiers. The DRV8343x-Q1EVM is also designed to be configured in different independent mode settings to drive unidirectional motors, solenoids, or both.

The DRV8343-Q1 device is used in motor control applications that require a high degree of integrated protection, diagnosis, and monitoring. Both SPI (DRV8343S) and hardware (DRV8343H) interface variants provide detailed fault reporting and flexible parameter settings such as current control options for slew-rate control of the gate drivers and various protection features. [Figure 1](#) shows the top 3D view of the DRV8343x-Q1EVM highlighting the key components of the board.

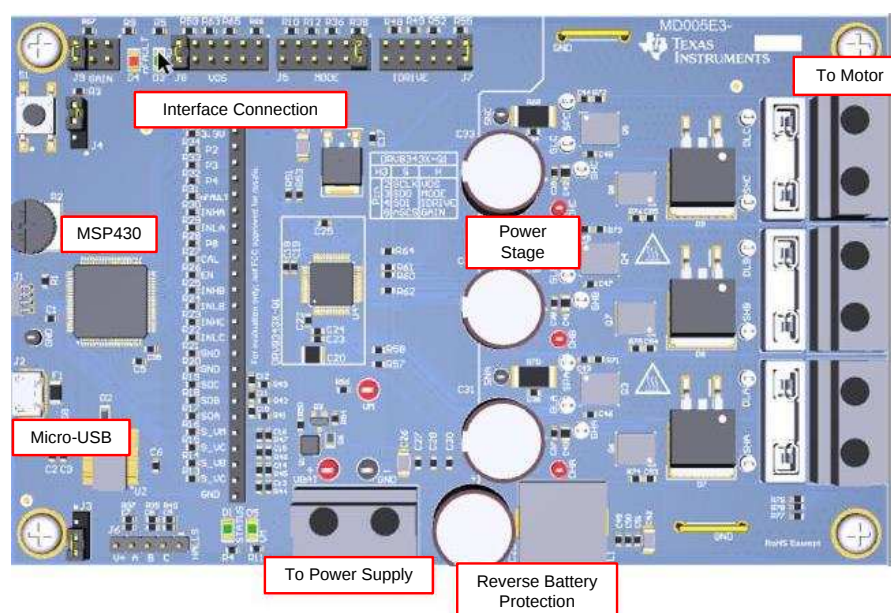


Figure 1. DRV8343x-Q1EVM Top View

2 Hardware and Software Overview

2.1 Hardware Overview

2.1.1 Features

The following lists the DRV8343x-Q1EVM key features:

- Operating supply range from 6 V to 48 V
- Six CSD18540Q5B N-channel NexFETs driven by the gate driver
- Protected phase voltages provided to header pins through a voltage divider
- Connector available for Hall sensor inputs connected to the MSP430™ MCU.
- Includes sample code for sensored and sensoreless BLDC implementation
- Includes sample code for independent mode to drive BDC motors and solenoids configurations

2.1.2 DRV8343x-Q1EVM Overview

Figure 2 shows the major blocks of the hardware on the DRV8343x-Q1EVM.

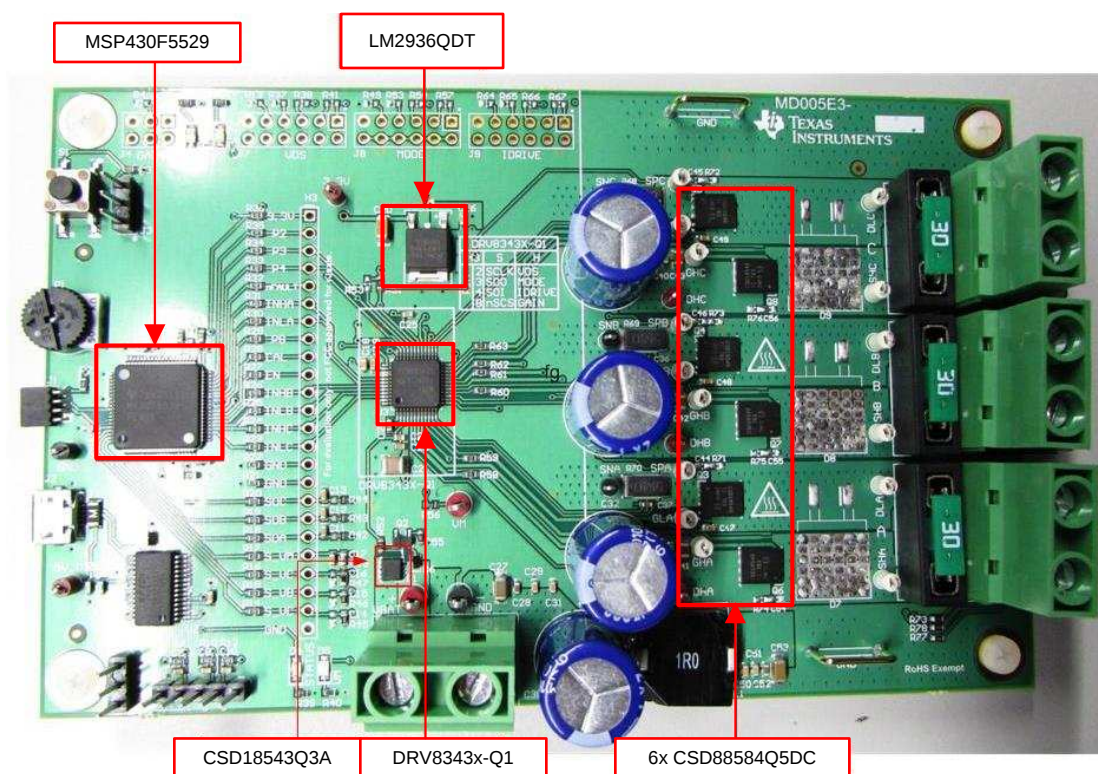


Figure 2. Board Overview

- **DRV8343-Q1 (U4)**: automotive 5.5 to 60-V three-phase Smart Gate Driver with three integrated current-shunt amplifiers
- **MSP430F5529 (U1)**: 25-MHz mixed signal microcontroller with 128 KB Flash, 8192 B SRAM, and 63 GPIOs
- **LM2936Q-Q1 (U3)**: ultralow quiescent current LDO voltage regulator
- **CSD18543Q3A (Q1)**: MOSFET, N-CH, 60 V, 35 A
- **CSD18540Q5B (Q3,Q4,Q5,Q6,Q7,Q8)**: MOSFET, N-CH, 60 V, 100 A



2.1.3 Pinout, Connectors, and Jumpers Overview

Figure 3 shows the board connectors and various test points on the DRV8343x-Q1EVM.

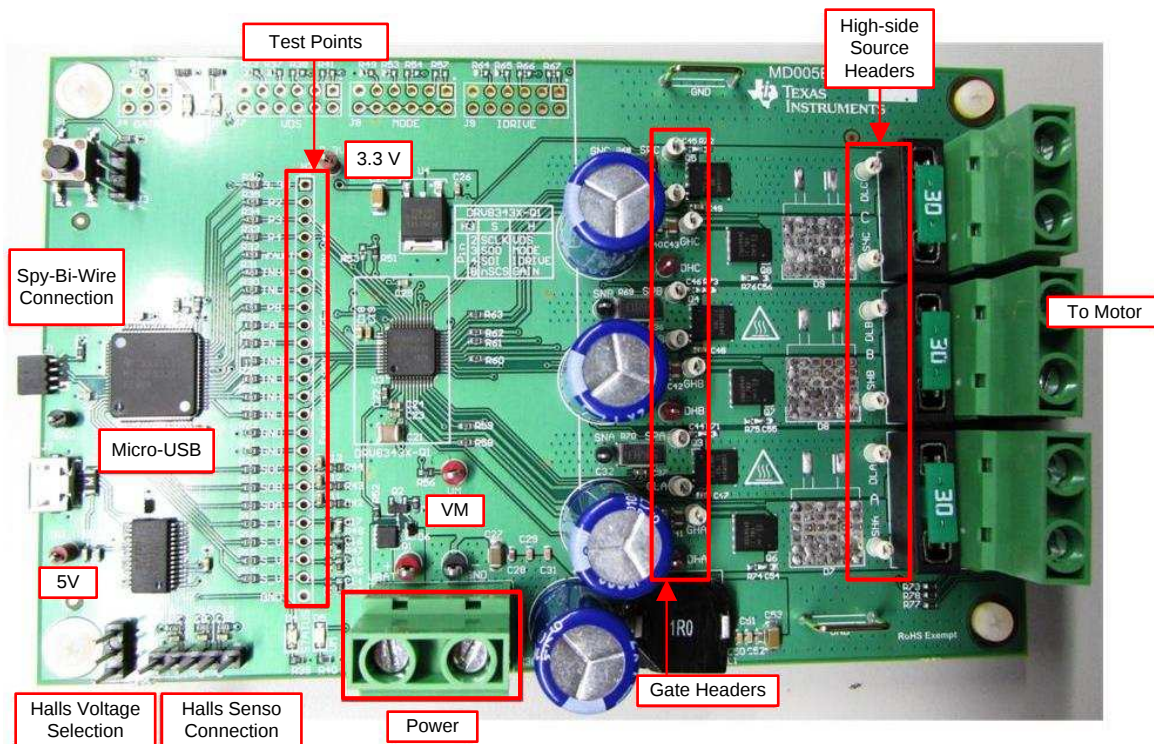


Figure 3. Connections Overview

Figure 4 shows the various header connections available on the DRV8343H-Q1EVM that are used to configure the control inputs to the DRV8343H-Q1 device.

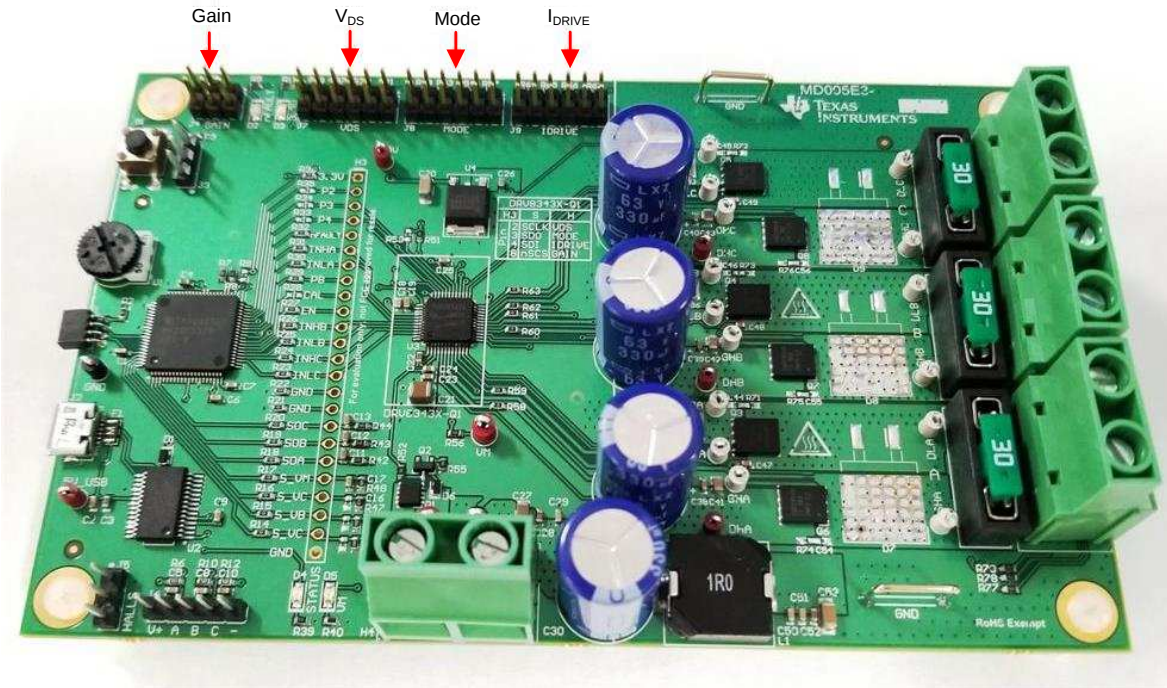


Figure 4. DRV8343H-Q1EVM

Table 1 and Table 2 list each of these jumper locations, starting from the right side of each jumper header.

Table 1. IDRIVE, MODE, and VDS Input Control Settings

JUMPER LOCATION	CONNECTION	IDRIVE (SINK/SOURCE)	MODE	VDS
First	Tied to DVDD	1 A / 2 A	Independent FET mode	Disabled
Second	18-k Ω resistor to DVDD	260 mA / 520 mA	Phase A in independent half-bridge mode Phase B and phase C in independent FET mode	1.88 V
Third	75-k Ω resistor to DVDD	200 mA / 400 mA	Phase B and phase C in independent half-bridge mode Phase A in independent FET mode	1.13 V
Forth	75-k Ω resistor to Ground	60 mA / 120 mA	1 x PWM	0.26 V
Fifth	18-k Ω resistor to Ground	10 mA / 20 mA	3 x PWM	0.13 V
Sixth	Tied to Ground	5 mA / 10 mA	6 x PWM	0.06 V
No jumper connector	Hi-Z mode	1.5 mA / 3 mA	Independent half-bridge mode	0.6 V

Table 2. GAIN Input Control Settings

JUMPER LOCATION	CONNECTION	GAIN
First	Tied to DVDD	40 V/V
Second	47-k Ω resistor to DVDD	10 V/V
Third	Tied to Ground	5 V/V
No jumper connection	Hi-Z mode	20 V/V

Both the DRV8343S-Q1EVM and DRV8343H-Q1EVM are configured as a BLDC driver board. The F2, F3, and F4 jumper connectors come preinstalled with the SHx pin connected to the DLx output of the DRV8343-Q1 device. The three-phase motor leads can then be connected to any of the 2-pin terminal connectors for the A, B, and C phase headers (H5, H6, and H7 respectively) as shown in [Figure 5](#).

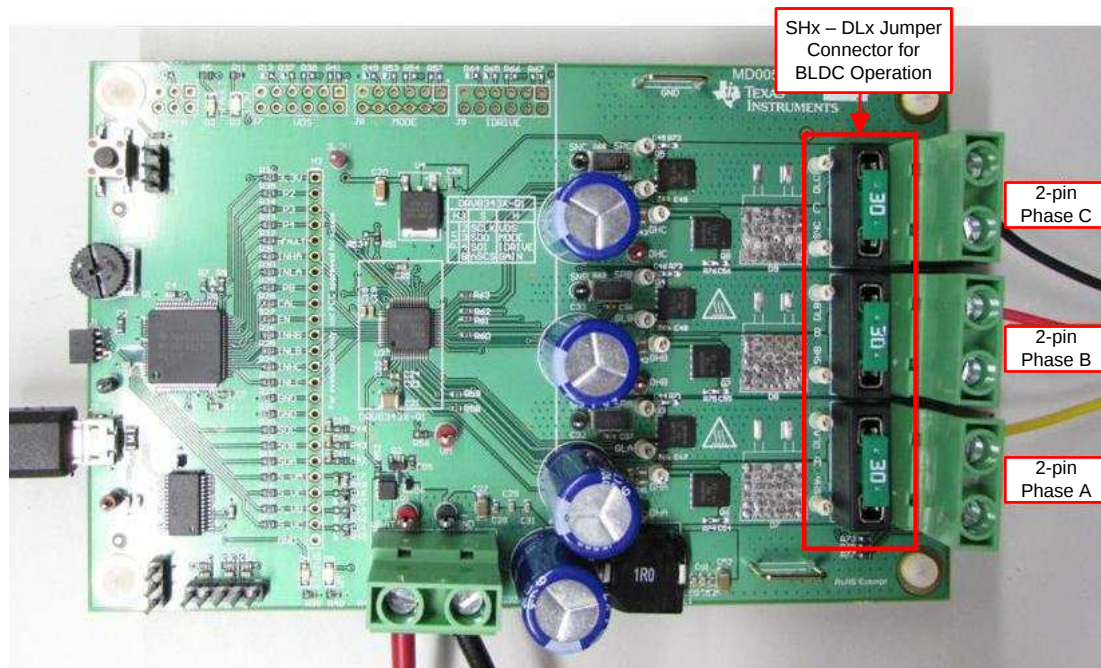


Figure 5. DRV8343x-Q1EVM BLDC Configuration

To configure the EVM board in an independent mode configuration, refer to the [DRV8343x-Q1EVM Independent Mode User's Guide](#).

2.1.4 Hardware, Software, and Tools Required for Evaluation

The software, hardware, and tools required to optimally evaluate the reference software code with the DRV8343x-Q1EVM are listed as follows:

- DRV8343x-Q1EVM
- Voltage supply from 6 V to 48 V
- Code Composer Studio™ software V.6.1 and above
- DRV8343x-Q1EVM GUI software
- DRV8343x-Q1EVM reference software development package (if different sensed firmware or independent mode is required)
- Spy-Bi-Wire programmer such as the MSP430G2553 LaunchPad™ development kit (If different sensed firmware or independent mode is required)

2.1.5 Hardware Connections for Hall Sensor Operation

[Table 3](#) lists the signal connections from the Hall sensor of the motor connected to jumper J6 on the DRV8343x-Q1EVM.

Additionally, the voltage supply for the Hall sensors can be adjusted from 3.3 V to 5 V for Hall sensors requiring 5-V power operation. The Hall power is configured by default for a 3.3-V supply. For a 5-V supply, the jumper should be placed close to the J5 designator.

NOTE: The 5-V supply is routed through the J2 connection and provided by the micro-USB port. The GUI is assumed to be used for Hall sensed operation, and therefore the 5-V supply should be provided this way.

Table 3. Hall Sensor Signal Connections to the DRV8343x-Q1EVM

SIGNAL DESCRIPTION	EQUIVALENT ON DRV8343x-Q1EVM
GND	J6-1(-)
Hall C	J6-2(C)
Hall B	J6-3(B)
Hall A	J6-4(A)
Hall Power	J6-5(+)

2.2 Hardware Setup

Use the following steps to set up the DRV8343x-Q1EVM for evaluation:

- Step 1. Confirm that the jumpers are configured correctly. For more information, see [Section 2.1.3](#).
- Step 2. Connect the motor phase wires to the terminal block headers, H5, H6, and H7. The order of the motor leads does not matter. The motor direction can be changed using the GUI or by reversing the direction of two of the motor phases.
- Step 3. Connect the power supply to the terminal block header, H4. Make sure the polarity is correct: positive to VBAT, negative to GND. Do not enable the power supply at this time.
- Step 4. Connect the micro-USB cable to the USB connector, J2. A cable is supplied with the DRV8343x-Q1EVM but any standard micro-USB cable should also work. Do not connect the EVM to the computer at this time.
- Step 5. Enable the power supply. The VM power supply LED, D5, and the 3.3-V power supply LED, D3, should light up.
- Step 6. Connect the micro-USB cable to the computer to run the GUI and interface with the DRV8343x-Q1EVM.

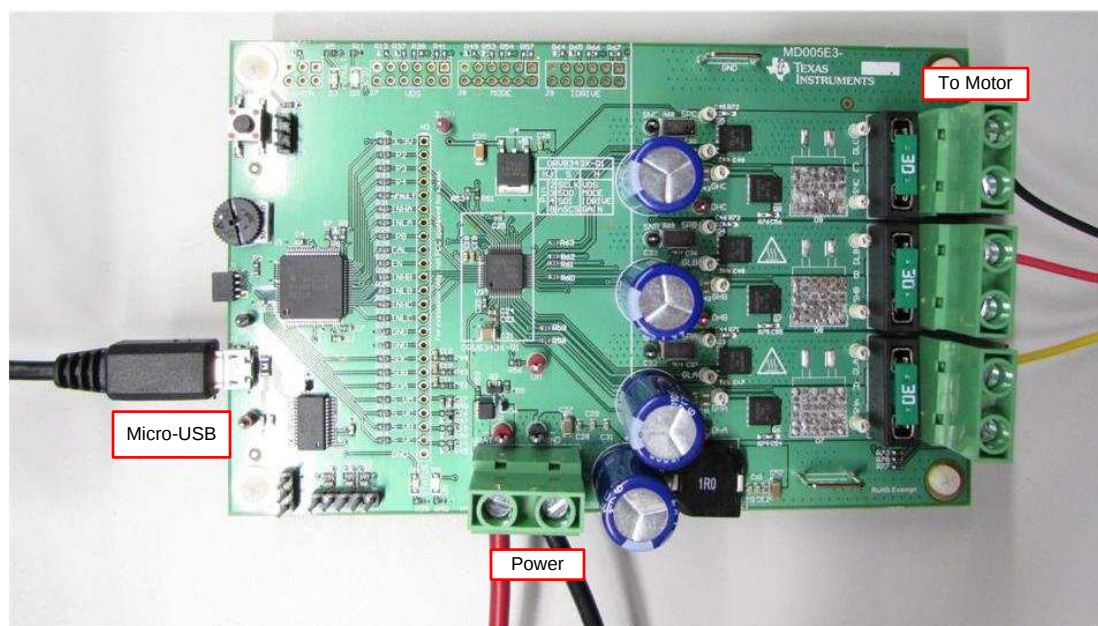


Figure 6. DRV8343x-Q1 Hardware Setup

2.3 Software and Tools Overview

The DRV8343x-Q1EVM comes with the trapezoidal sensoreless algorithm firmware preloaded onto the MSP430F5529 microcontroller. The DRV8343x-Q1EVM SDK package also includes firmware for Hall sensed evaluation and independent mode configuration. The following section describes the steps to install and configure the additional firmware available in the SDK package.

2.3.1 Installing CCS for Optional Software Evaluation

Code Composer Studio (CCS) version 6.1.0 or above is required to evaluate the for DRV8343-Q1X reference codes. Install an authorized version from www.ti.com/tool/ccstudio.

NOTE: A myTI login account is required to download CCS as well as the SDK package.



Figure 7. CCS v6 or Above Required

2.3.2 Installing DRV8343-Q1 Reference Software Development Package

The DRV8343-Q1 reference software contains the files required to program DRV8343-Q1 devices along with the MSP430F5529 using CCS v6.0.1. or above. All of these files are included in the installation package. To download this package, go to respective the EVMs tool page on [Ti.com](http://ti.com) ([DRV8343H-Q1EVM](#) or [DRV8343S-Q1EVM](#)).

Install the reference software development package using these steps:

- Step 1. Double click the executable file (.exe) for the DRV8343-Q1 reference software installer (see [Figure 8](#)).

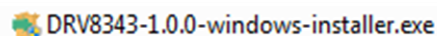


Figure 8. DRV8343-Q1 Firmware Installer Executable File

- Step 2. Follow the prompts to select another language from the default of English (see [Figure 9](#)).

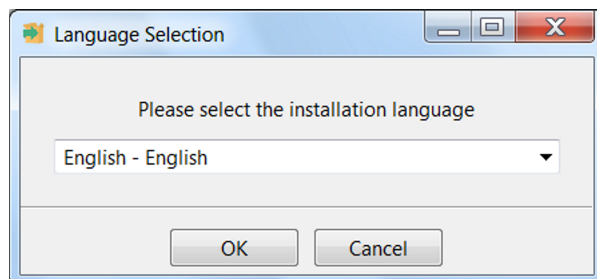


Figure 9. Language Selection

Step 3. Click the *Next* button on the DRV8343-Q1 installer welcome screen (see [Figure 10](#)).



Figure 10. Setup Home Screen

Step 4. Read though and accept the license agreement to proceed with the installation (see [Figure 11](#)).



Figure 11. DRV8343-Q1 Software License Agreement

- Step 5. Choose the destination location for the example CCS projects and the documentation (see [Figure 12](#)). This destination can be set to any location in the PC.

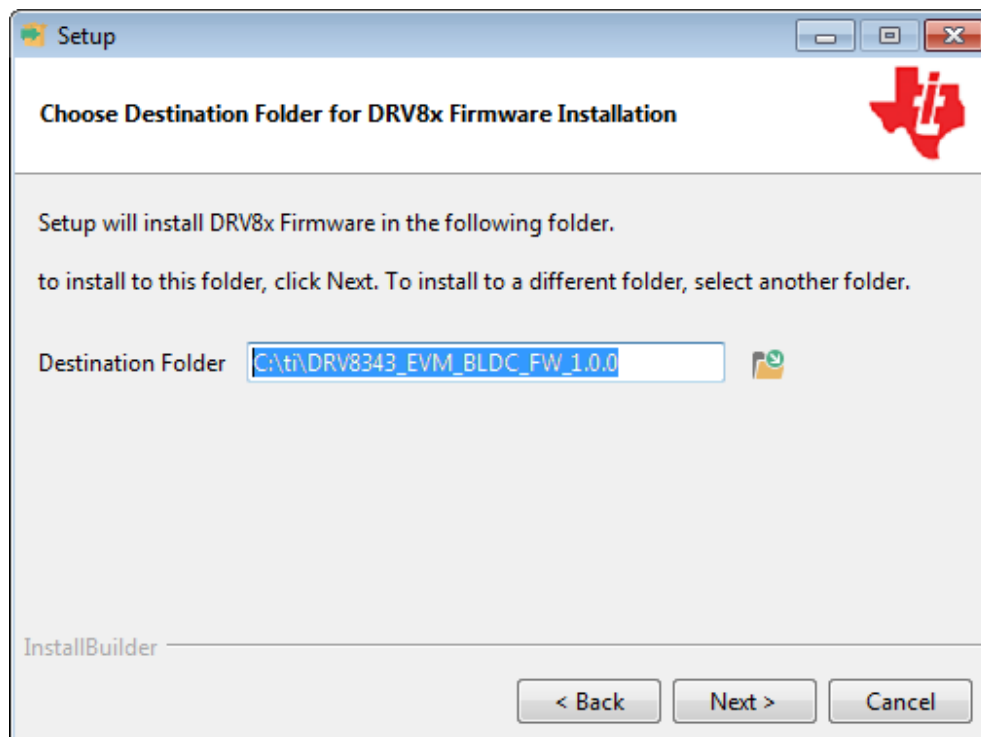


Figure 12. Setup Destination Folder

- Step 6. Select each DRV83x component to install (see [Figure 13](#)).

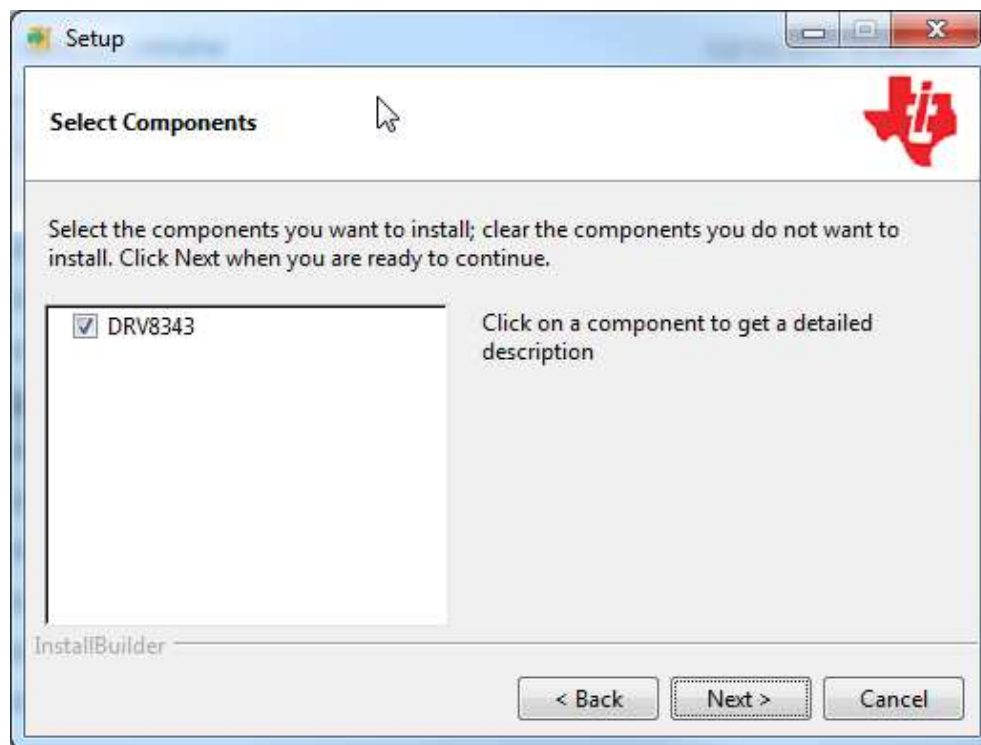


Figure 13. Select DRV8343-Q1 Setup Components

Step 7. Ensure all running instances of CCS are closed (see [Figure 14](#)).

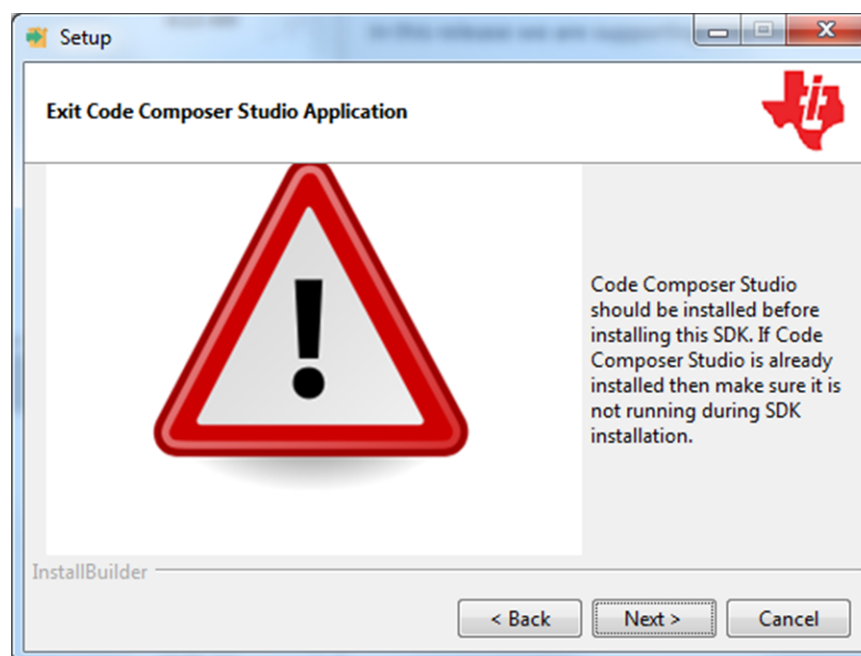


Figure 14. Warning Message to Close CCS

Step 8. Continue with the installation process.

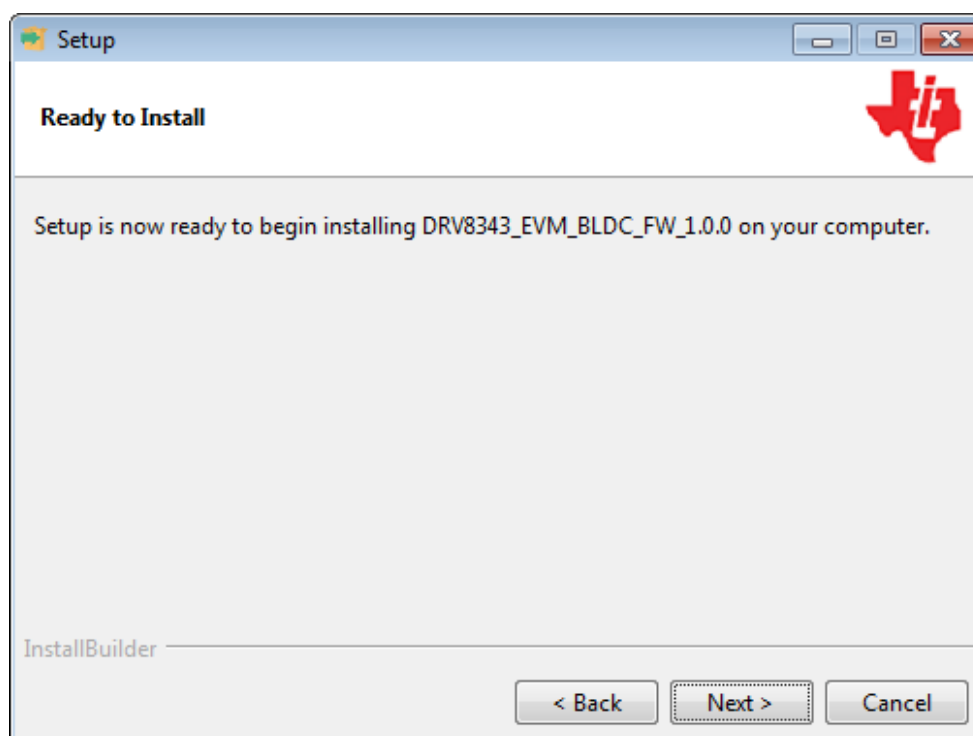


Figure 15. Setup Ready to Install

Step 9. Click the *Next* button to install after reviewing the settings.

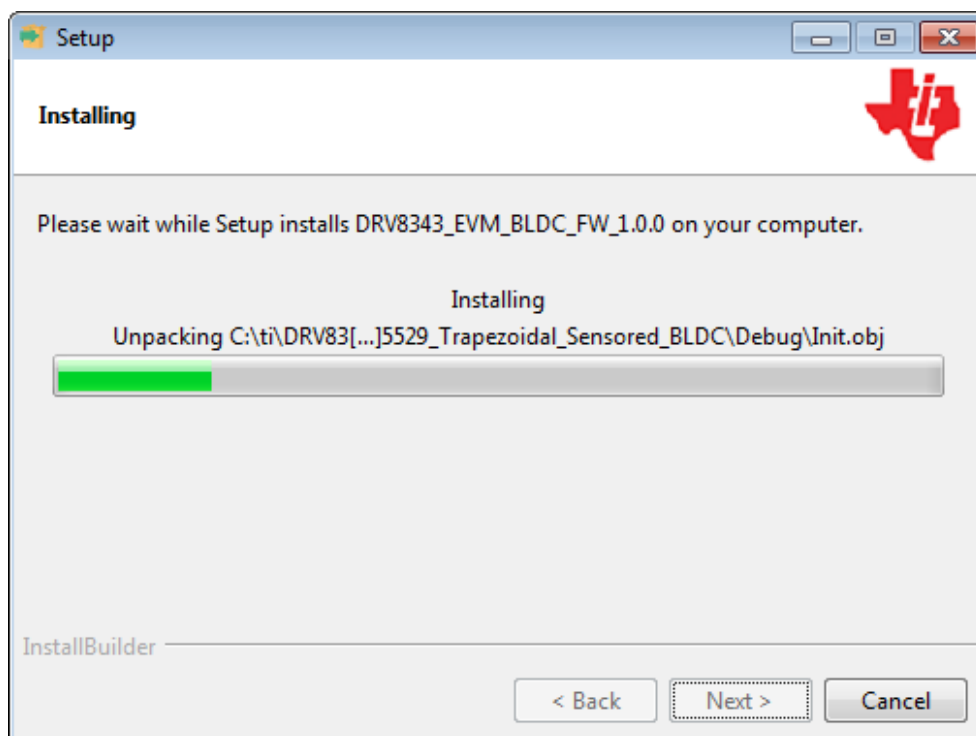


Figure 16. Installing Firmware

Step 10. Click the *Finish* button when the files are successfully installed in the destination folder (see [Figure 17](#)).



Figure 17. Firmware Setup Complete

2.3.3 Creating or Importing a DRV8343-Q1 Project Into CCS

When the CCS software is started, the user must first select a workspace. A workspace is the structure in which projects are kept. Multiple projects can be saved in one workspace. After importing an existing project, the user can explore the features of CCS to become familiar with the IDE. Follow these steps to import the provided project:

- Step 1. Double click the CCS icon to open the application. A CCS icon is placed on the desktop after installation.



Figure 18. Open CCS Application

- Step 2. Select the location and name of the workspace. The location and naming convention can be changed. (see [Figure 19](#)).
- Step 3. Click the OK button to accept.

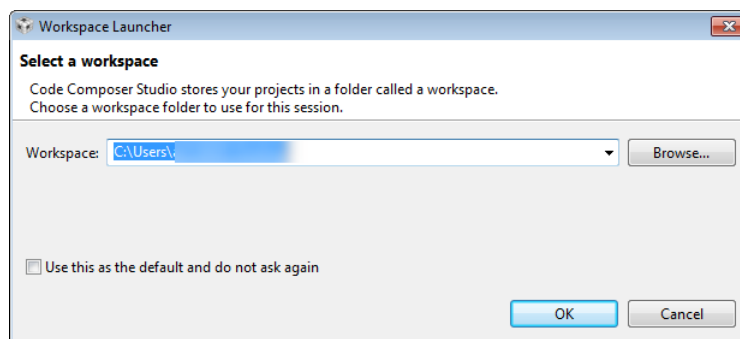


Figure 19. Workspace Selection

After selecting the workspace, the CCS software opens displaying a welcome menu.

- Step 4. Import a project either from the welcome menu by selecting *Import Project* or go to the *Project* menu and select *Import Existing CCS Eclipse Project* (see [Figure 20](#)).

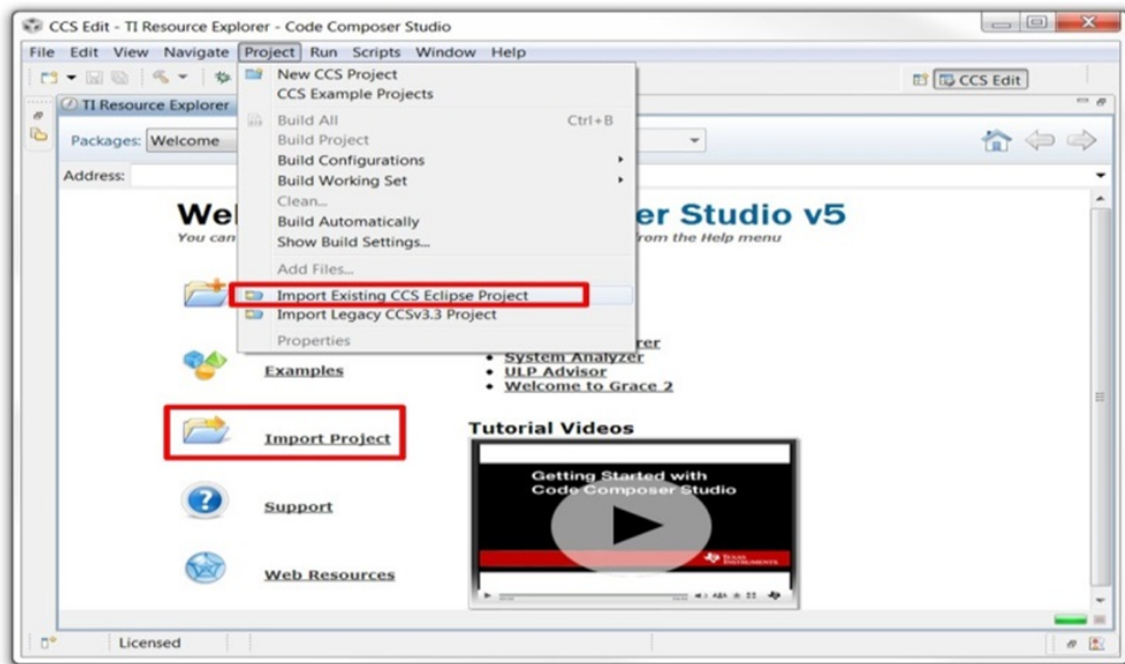


Figure 20. Importing CSS Project

- Step 5. In the new window that appears showing the import options, click the *Browse...* button and find the provided projects through the folder browser. These projects are located in the SDK installation directory. The default location of the root folder is under C:\ti (see [Figure 22](#)). When selected, the provided project appears under *Discovered Projects*.

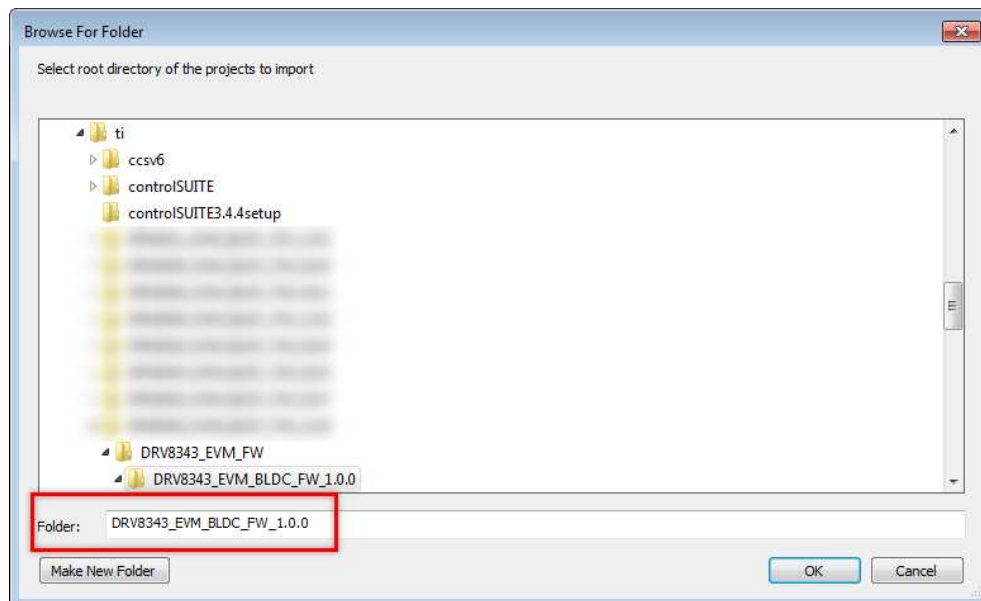


Figure 21. Select DRV8343_EVM_BLDC_FW_1.0.0 Folder

- Step 6. Make sure the correct box is checked and then click the *Finish* button (see [Figure 22](#)).

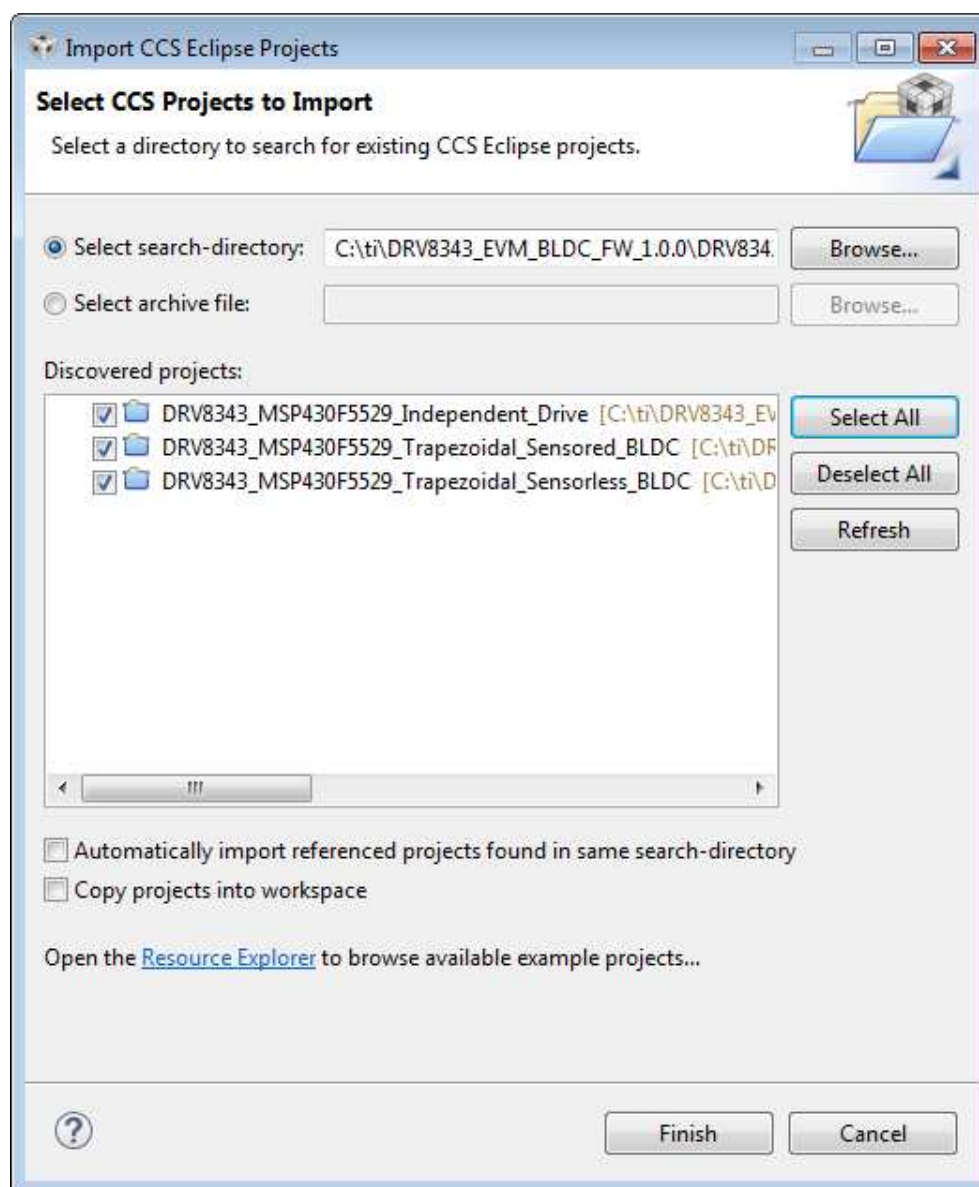


Figure 22. Select Projects to Import

When the projects are imported to the workspace, the project should appear in the *Project Explorer* window as shown in [Figure 23](#).

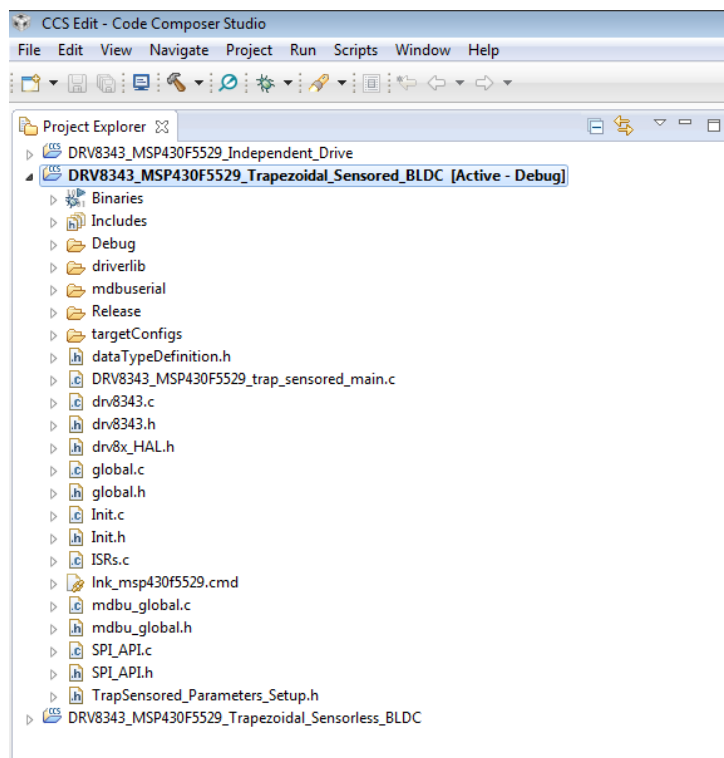


Figure 23. Project Explorer

- Step 7. Explore the project files, build the project to create an image to be downloaded on the MSP430F5529 hardware, and download the project from here. Make sure the MSP430F5529 is connected to the PC through USB interface before downloading the code.

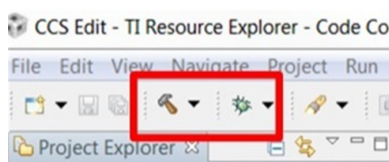


Figure 24. Build and Debug

- Step 8. When the CCS software is connected to the device, run the program from CCS to execute the program in hardware by clicking the green play button (see [Figure 25](#)). Click the red stop button (see [Figure 25](#)) to disconnect from the device debugger.



Figure 25. Run and Pause Debug Session

2.3.4 GUI Application

2.3.4.1 Installation

Follow these steps to install the GUI application:

- Step 1. Download and run the *Setup_DRV8343-xQ1-1.0.0_EVM_GUI.exe* installer file to install the GUI application.

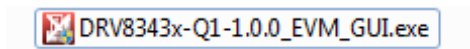


Figure 26. GUI Executable

- Step 2. Click the *Next* button on the welcome screen of the DRV8343-Q1 installer (see [Figure 27](#)).

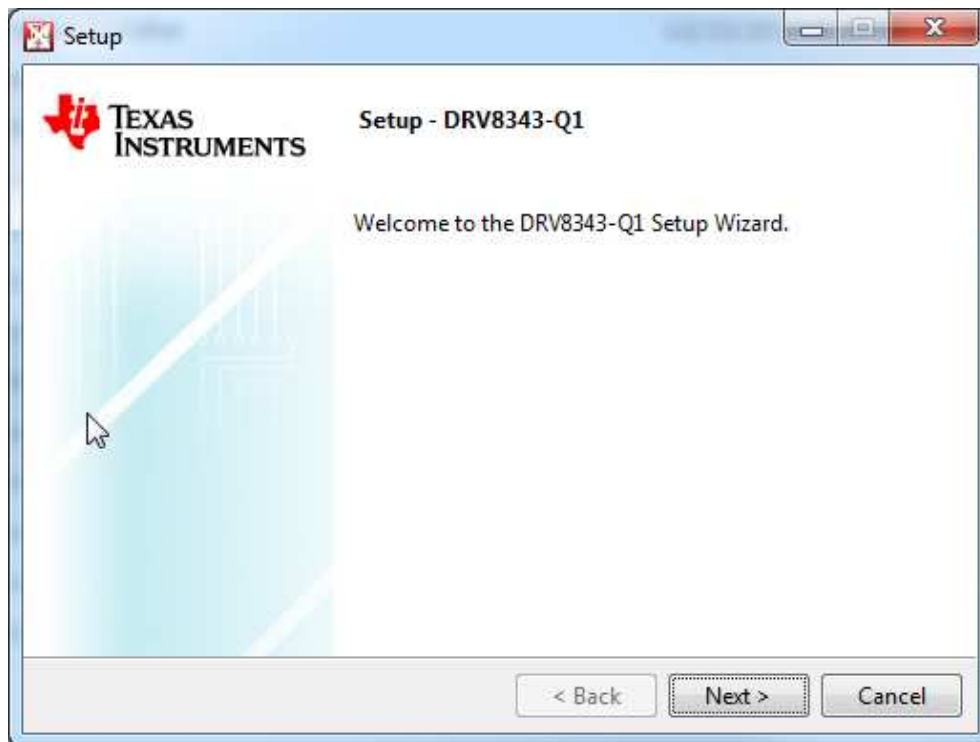


Figure 27. Setup GUI Home Screen

- Step 3. Read though and accept the license agreement to proceed with the installation (see [Figure 28](#)).



Figure 28. License Agreement

- Step 4. Review the new *Setup* window which lists the installation directory where the GUI files will be installed (see [Figure 29](#)). Click the *Next* button to proceed.

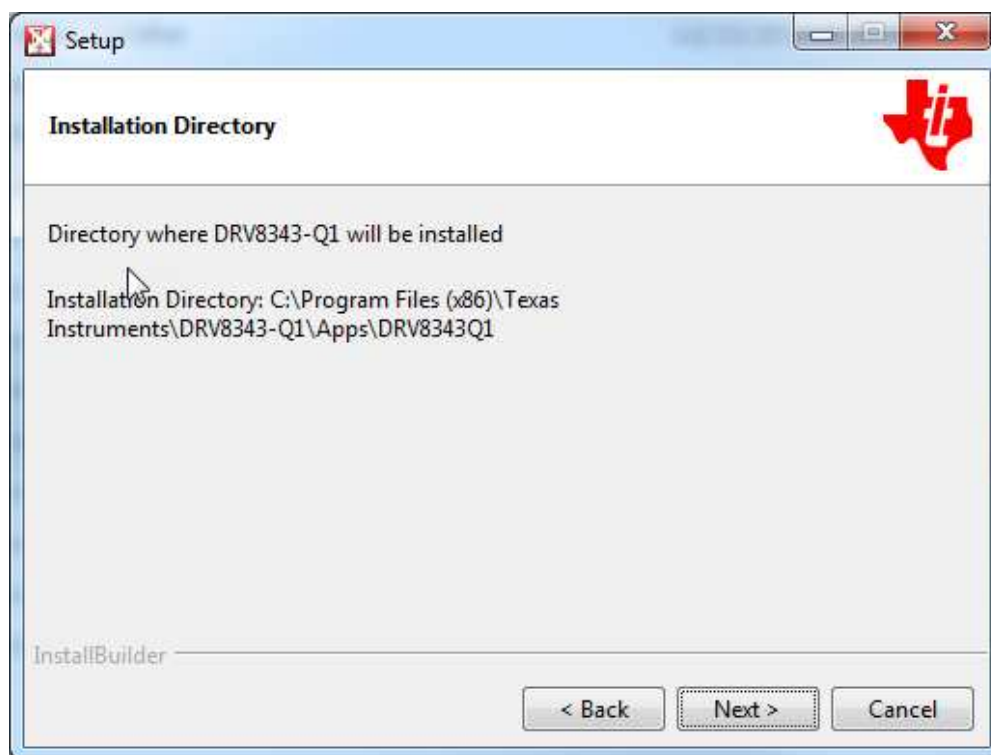


Figure 29. Installation Directory

- Step 5. Click the *Next* button when the setup is complete and GUI installation is ready to start (see

Figure 30).

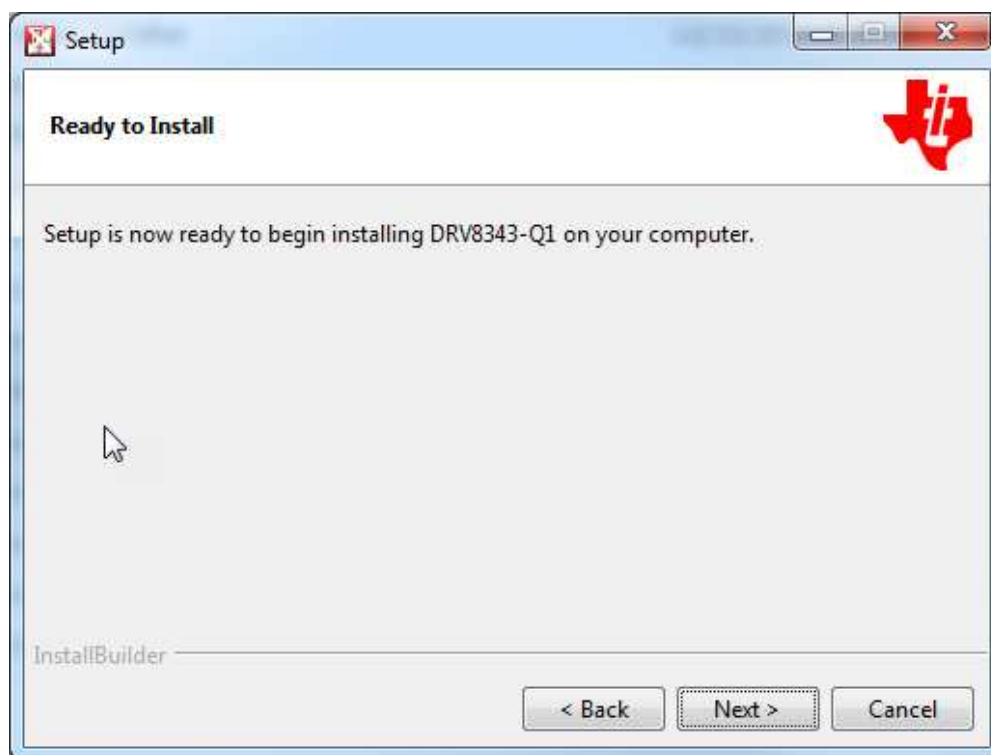


Figure 30. Ready to Install

Step 6. Click the Yes button in the new window to create a shortcut on the desktop if desired. The GUI then starts the installation (see Figure 31).

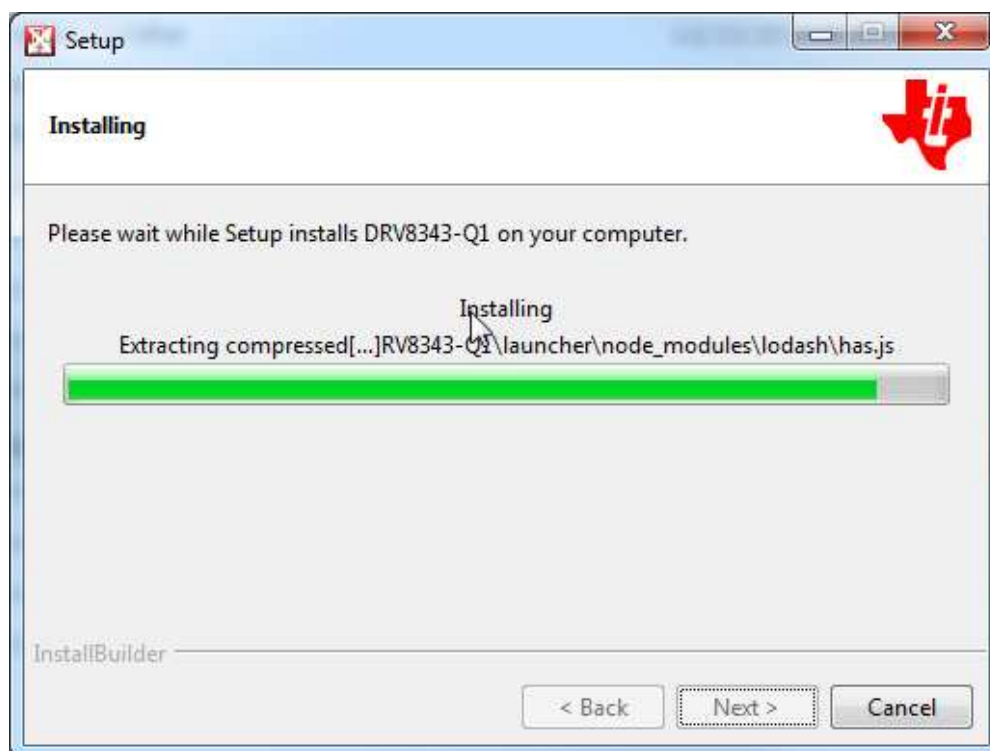


Figure 31. Installing the GUI

- Step 7. Click the *Finish* button when the files are successfully installed in the destination folder (see [Figure 32](#)).



Figure 32. GUI Setup Complete

- Step 8. The GUI uses an FTDI to enable USB communication. If the FTDI driver is not already installed download the latest VCP window driver executable from the FTDI website (<http://www.ftdichip.com/Drivers/VCP.htm>)

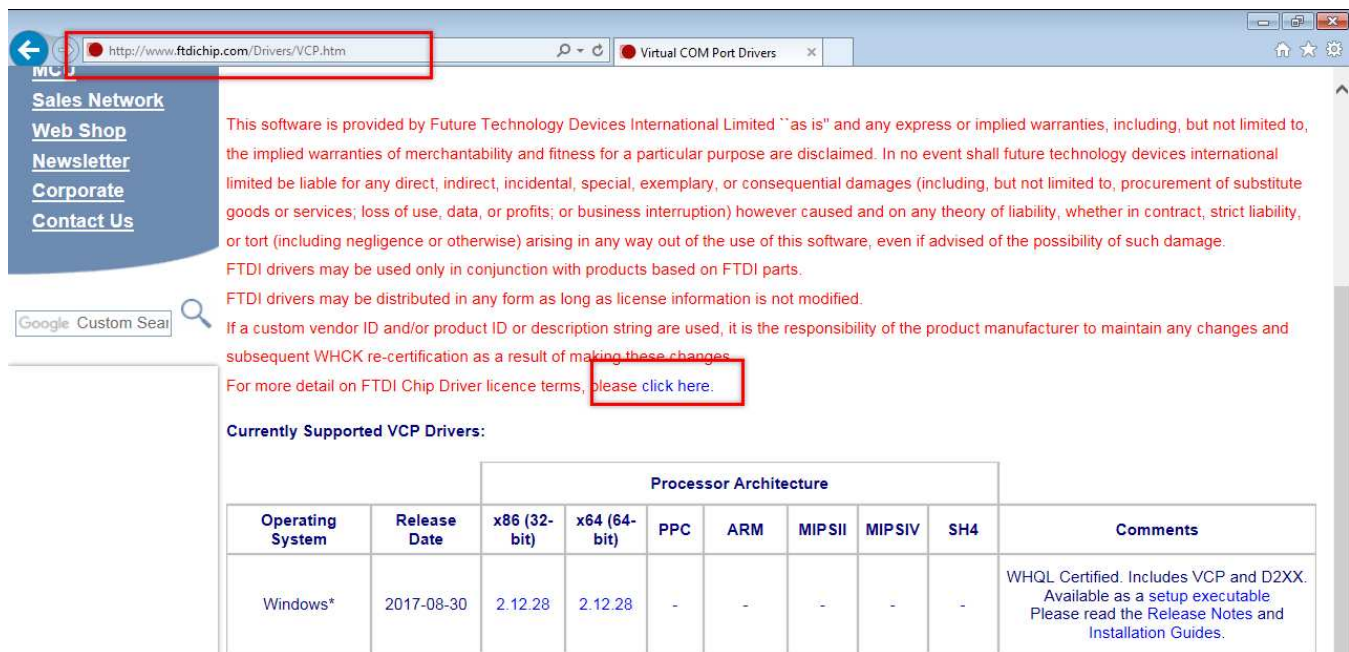


Figure 33. FTDI Driver Installation

Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from A Revision (April 2018) to B Revision Page

- Added DRV8343x-Q1EVM can also be used to evaluate the DRV8340x-Q1 statement [2](#)

Revision History

Changes from Original (January 2018) to A Revision Page

- Changed the maximum supply voltage from 60 V to 48 V in the *Features and Hardware, Software, and Tools Required for Evaluation* sections [3](#)

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